



Complete Summary

GUIDELINE TITLE

Care of the neonate requiring parenteral nutrition.

BIBLIOGRAPHIC SOURCE(S)

National Association of Neonatal Nurses. Care of the neonate requiring parenteral nutrition. Glenview (IL): National Association of Neonatal Nurses; 1999. 34 p. [13 references]

COMPLETE SUMMARY CONTENT

SCOPE
METHODOLOGY - including Rating Scheme and Cost Analysis
RECOMMENDATIONS
EVIDENCE SUPPORTING THE RECOMMENDATIONS
BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS
QUALIFYING STATEMENTS
IMPLEMENTATION OF THE GUIDELINE
INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT
CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

Neonatal malnutrition

GUIDELINE CATEGORY

Management

CLINICAL SPECIALTY

Nursing
Pediatrics

INTENDED USERS

Advanced Practice Nurses
Nurses

GUIDELINE OBJECTIVE(S)

To assist neonatal nurses in the care of neonates requiring parenteral nutrition.

TARGET POPULATION

Premature (low birthweight [LBW] and very low birthweight [VLBW]) and full-term neonates who cannot be fed or whose total nutritional requirements cannot be met through enteral feedings alone.

INTERVENTIONS AND PRACTICES CONSIDERED

Care of the neonate receiving parenteral nutrition (PN):

1. Review of institutional policy
2. Proper handling of the PN solution
3. Administration of PN, including IV access and patency, medication compatibility, and infusion rate
4. Nutritional status monitoring, including growth rate and physical and biochemical parameters
5. Assessment for potential complications

MAJOR OUTCOMES CONSIDERED

- Adequate nutritional status as reflected by:
 - Biochemical parameters
 - Weight, head circumference, length or other parameters
 - Hydration and fluid balance
- Catheter-related and other complications of nutrition therapy

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The MEDLINE, Cochrane, and Vermont Oxford databases were searched by the guideline developer using the keywords neonate and nutrition.

NUMBER OF SOURCE DOCUMENTS

Approximately 50

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Subjective Review

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not applicable

METHODS USED TO ANALYZE THE EVIDENCE

Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not applicable

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Not stated

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

The American Academy of Pediatrics volunteered to review the initial drafts of the document. In addition to the NANN Board of Directors who reviewed these guidelines prior to publication, other contributors and reviewers are recognized in the guideline document for their assistance.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

Foundational Knowledge for Managing Neonatal Parenteral Nutrition (PN)

1. Knowledge of the normal range for common laboratory values.

Nurses must be knowledgeable about laboratory values in order to identify and prevent nutritional problems.

Common laboratory tests performed include sodium, potassium, chloride, carbon dioxide, blood urea nitrogen (BUN), calcium (total and ionized),

creatinine, glucose, magnesium, phosphorous, total bilirubin, and triglycerides.

Normal values for these tests are given in the guideline document.

2. Knowledge of the nutritional requirements of preterm and term neonates.
 - Since practices vary from one institution to another, a review of institutional policy regarding recommended amounts of various nutrients is recommended.
 - Suggested intake of the usual components of PN are:

Protein. 8 to 12% of calories

Fat. 35 to 55% of calories

Carbohydrates. 35 to 55% of calories

The actual nutritional need of the neonate is ultimately determined by the clinical condition of the individual neonate. The guideline document contains suggested dosage regimens and relevant comments.

- Premature infants have greater nutritional needs than term infants do, because many nutrients (fat, vitamins, minerals, and trace elements) are acquired transplacentally during the last trimester.
3. Knowledge of the components of PN

Usual components of PN

Component	Additive	Form
Protein	Amino acids	Crystalline amino acids
Fat	Lipids	10 to 20% emulsions
Electrolytes	Sodium, potassium, chloride, phosphorous, calcium, magnesium	May be provided as a stock solution or calculated to individual infant's needs
Vitamins	Fat-soluble vitamins	A,D,E,K
	Water-soluble vitamins	C, thiamin, niacin, riboflavin, folate pyridoxine, biotin, B12, pantothenate
Trace elements	Zinc, copper, manganese, selenium,	See guideline text for further information

	chromium, molybdenum, iodine Iron	Iron is supplied separately
Carbohydrates	Dextrose	Monohydrate form

Trace elements

- During the first two weeks of life, the only trace element that is essential is zinc. Deficiencies in other micro-minerals are not likely to occur during this time. However, if PN is used for longer than two weeks, all the elements listed above should be included to prevent deficiencies and to replace body stores during growth. Copper and manganese supplements should be omitted if hepatic disease is present. Similarly, selenium and chromium undergo renal excretion, so the doses should be lowered if there is decreased renal output.

Carbohydrates

- The carbohydrate contained in PN is dextrose. Neonates, especially very low birthweight (VLBW) neonates, may have difficulty tolerating intravenous glucose. Frequent monitoring of glucose tolerance is essential in order to identify those vulnerable VLBW neonates.
- Alterations in glucose concentration will be dictated by the neonate's gestational age, laboratory data, and clinical condition. It is necessary to utilize clinical judgment in this area, as one cannot predict what amount of glucose a particular neonate will tolerate. Generally dextrose should be advanced slowly and by not more than 1 to 2 mg/kg/minute each day. The guideline document provides a detailed discussion about the Glucose Infusion Rate (GIR).

Protein

- It is suggested that IV protein (and other nutrients) be tapered and discontinued when most caloric intake is enteric and neonate is gaining weight. How to taper and when to discontinue PN as enteral feedings are advanced remain highly debatable questions. Practices vary from hospital to hospital and even among practitioners in individual nurseries. It is recommended that unit policy be consulted.

Fat

- Neonates of less than 32 weeks gestation have decreased lipid tolerance. There is evidence to suggest that LBW infants receiving 20% emulsions have lower cholesterol, triglyceride, and phospholipid levels than those who receive the same dose (gm/kg) of 10% lipids. Therefore it is recommended that a 20% lipid preparation be used, especially in these LBW and VLBW infants.

- It is recommended that infusions be decreased or temporarily discontinued during acute infections. Although nutritional needs are increased at this time, tolerance of lipids may be affected during sepsis because the rate of lipid oxidation is reduced, leading to an accumulation of free fatty acids.
4. Knowledge of the neonate's caloric requirements and circumstances that modify those requirements
 - The caloric intake must be sufficient to meet metabolic needs and to support growth. Recommended intake varies from 70 to 100 cal/kg/day.
 - There are instances in which the metabolic needs of the neonate are increased, mandating a greater caloric intake:
 - Low birth weight: prematurity, intrauterine growth retardation (IUGR)
 - Illness and/or surgery: respiratory distress, hypoxia, sepsis, diarrhea, seizures, congenital heart disease
 - Hyperactivity: drug withdrawal
 - Specific dynamic action of feeding (energy cost of digestion and metabolism)
 - Cold stress
 - Environmental stress
 - Growth
 5. Calculating caloric intake.

The nurse should know how caloric intake is calculated. Examples are presented and discussed in the guideline.

6. Monitoring the neonate for adequate nutritional status

The adequacy of the neonate's diet can be evaluated by growth rate and assessment of physical and biochemical parameters.

Growth rate. Plotting the neonate's daily weight gain or loss on a growth chart makes it possible to evaluate the adequacy of growth. The growth chart selected for use should accurately reflect the geographic location and the ethnic, socioeconomic, and demographic characteristics of the patient population.

Physical parameters. Changes in head and arm circumferences, skin fold thickness, and length can be followed weekly or biweekly. Weight, head circumference, and length are the most frequently used anthropometric measures. Other parameters, such as hydration status, skin integrity, calculation of intake relative to requirements, and tolerance of enteral feedings, should be evaluated daily.

Biochemical parameters. To ensure optimal outcome and minimize complications, biochemical monitoring is critical to neonates receiving PN. Frequency of monitoring varies from unit to unit. A suggested schedule is included in the guideline document. The variables monitored are: electrolytes; Dextrostix or Accu-check; BUN; calcium; bilirubin; creatinine, magnesium, phosphorous, alkaline/phosphatase, albumin, bicarbonate, SGOT (aspartate aminotransferase); SGPT (alanine aminotransferase), cholesterol; acid-base

status; hematocrit/hemoglobin; triglycerides; complete blood count with differential and blood culture.

7. Complications of PN

Although the use of PN represents a great advance in the care of high-risk neonates, it is not without risks. Some of the complications that may be encountered are:

Metabolic: Glucose imbalances, hypo/hypercalcemia, electrolyte abnormalities, metabolic bone disorder, hypophosphatemia, metabolic acidosis, cholestasis, abnormal liver function, essential fatty acid deficiency, elevated triglycerides, deficiency of trace minerals, azotemia, hyperammonemia

Acquired infections: Bacterial sepsis (*S. epidermidis*, *S. aureus*), Fungal sepsis (*M. furfur*, *C. albicans*)

Central catheter related: improper placement, cardiac arrhythmias, venous thrombosis, embolism, hydrothorax, pericardial effusion, and cardiac tamponade

Peripheral catheter related: infiltration, phlebitis, skin slough/necrosis

Most of these complications may be avoided with close monitoring and timely interventions. PN should be administered according to established protocols.

CLINICAL ALGORITHM(S)

None provided

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is not specifically stated for each recommendation.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Close adherence to the suggested interventions will help to prevent nutritional deficiencies and will enable the neonate to receive nutrition adequate to foster growth and wellness.

POTENTIAL HARMS

Potential complications of parenteral nutrition include:

Metabolic: Glucose imbalances, hypo/hypercalcemia, electrolyte abnormalities, metabolic bone disorder, hypophosphatemia, metabolic acidosis, cholestasis, abnormal liver function, essential fatty acid deficiency, elevated triglycerides, deficiency of trace minerals, azotemia, hyperammonemia

Acquired infections: Bacterial sepsis (*S. epidermidis*, *S. aureus*), Fungal sepsis (*M. furfur*, *C. albicans*)

Central catheter related: improper placement, cardiac arrhythmias, venous thrombosis, embolism, hydrothorax, pericardial effusion, cardiac tamponade

Peripheral catheter related: infiltration, phlebitis, skin slough/necrosis Not stated

QUALIFYING STATEMENTS

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This guideline does not preclude the use of other acceptable methods of caring for infants who require parenteral nutrition. Additional practices known to improve the quality of neonatal care are encouraged and not restricted despite the development of this document.

Despite the progress achieved in the area of nutritional support, providing appropriate nutrition to neonates remains a challenging task. There is still a need for sound, scientific evidence on which to base practice interventions.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness
Safety

IDENTIFYING INFORMATION AND AVAILABILITY

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ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1999

GUIDELINE DEVELOPER(S)

National Association of Neonatal Nurses - Professional Association

SOURCE(S) OF FUNDING

National Association of Neonatal Nurses (NANN)

GUIDELINE COMMITTEE

Education and Practice Committee

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

An update is not in progress at this time.

GUIDELINE AVAILABILITY

Electronic copies: Not available at this time.

Print copies: Available from the National Association of Neonatal Nurses (NANN), 4700 W. Lake Avenue, Glenview, IL 60025-1485. An order form is available at the [NANN Web site](#).

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This summary was completed by ECRI on February 28, 2000, 1999. The information was verified by the guideline developer on March 10, 2000.

COPYRIGHT STATEMENT

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The logo for FIRSTGOV, with "FIRST" in blue and "GOV" in red, and a small red star above the "I".

